

Anatomy of: larynx, trachea, and bronchi

Respiratory Block
ANATOMY
team 435

(ما حك جلدك مثل ظفرك)
-الامام الشافعي

If you want something done right, you have to do it yourself.



C O L O R C O D E S

- IMPORTANT NOTES
- EXTRA NOTES
- DEFINITION

Objectives

By the end of the lecture, you should be able to:

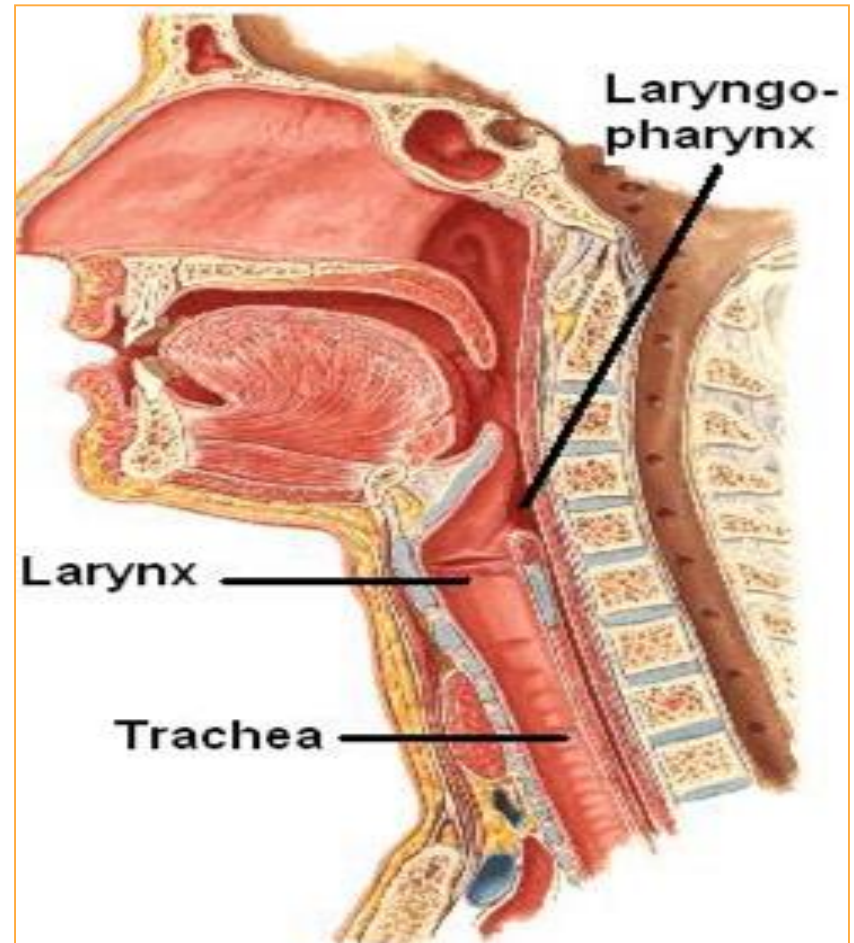
- Describe the Extent, structure and functions of the larynx.
- Describe the Extent, structure and functions of the trachea.
- Describe the bronchi and branching of the bronchial tree.
- Describe the functions of bronchi and their divisions.

Larynx

- The larynx is the part of the respiratory tract which **contains the vocal cords**.
- In adults, it is **2-inch-long** tube.
- It opens:
 1. **above** into the **laryngeal part** of the **pharynx**.
 2. **Below** it is continuous with the **trachea**

The larynx has functions in:

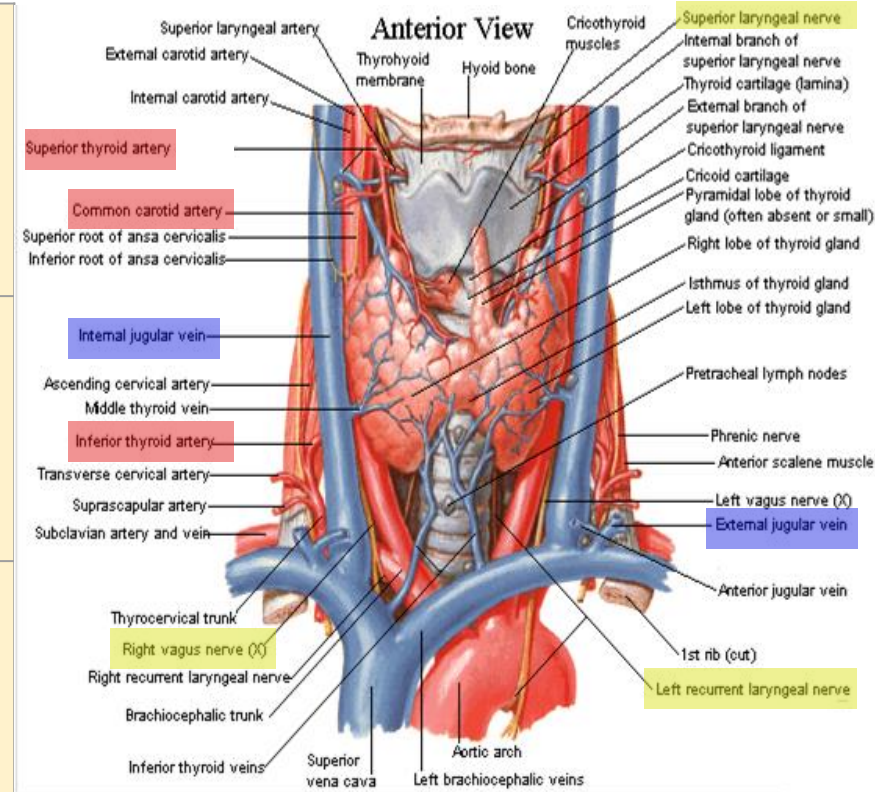
1. **Respiration** (breathing).
2. **Phonation** (voice production).
3. **Deglutition** (swallowing).



Relations of larynx

The larynx is related to major critical structures in the neck.

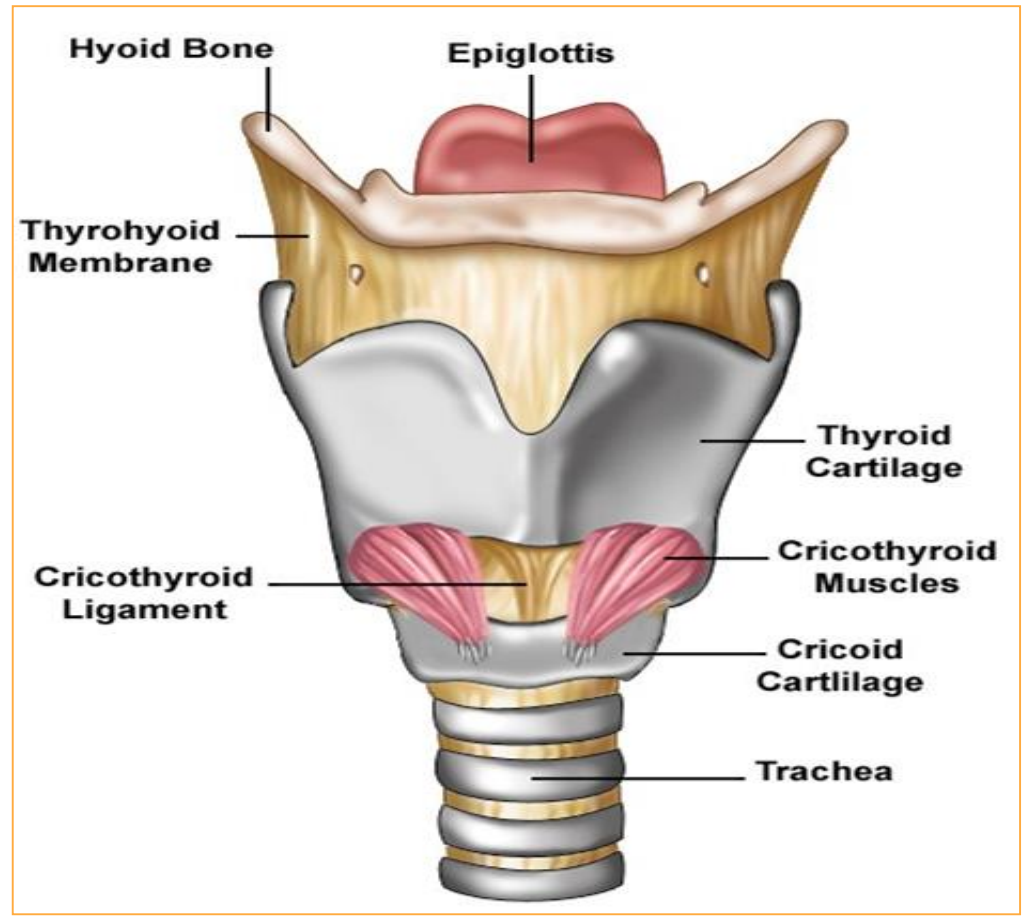
<p>Arteries</p>	<p>Carotid arteries: (common Carotid):</p> <ol style="list-style-type: none"> external Carotid internal Carotid. 	<p>Thyroid arteries:</p> <ol style="list-style-type: none"> superior Thyroid inferior Thyroid
<p>Veins</p>	<p>Jugular veins:</p> <ol style="list-style-type: none"> external Jugular internal Jugular 	<p>-----</p>
<p>Nerves</p>	<p>Laryngeal nerves:</p> <ol style="list-style-type: none"> Superior laryngeal recurrent laryngeal 	<p>vagus nerve.</p>



Structure

The larynx consists of **4** basic components:

- 1- Cartilaginous skeleton**
- 2- Membranes and ligaments**
- 3- Mucosal lining**
- 4- Muscles (Intrinsic & extrinsic muscles)**



1-Cartilages

•The cartilaginous skeleton is composed of **9** cartilages:

3 Single:

- 1.Thyroid
- 2.Cricoid
- 3.Epiglottis

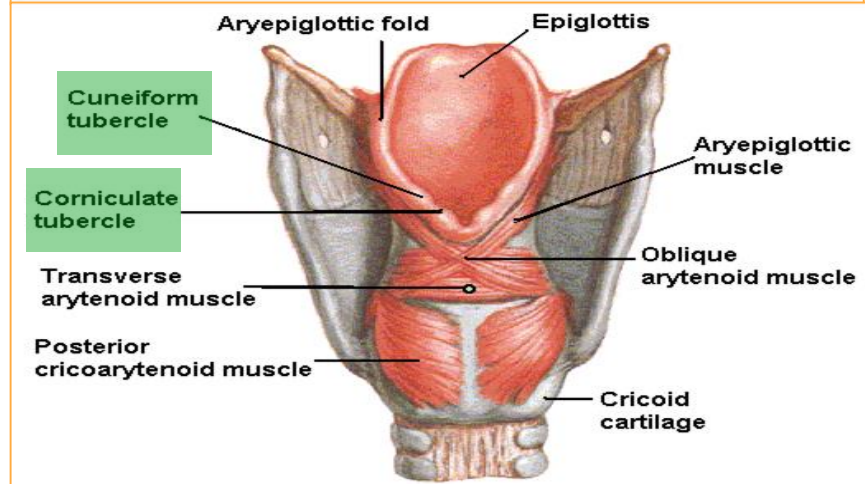
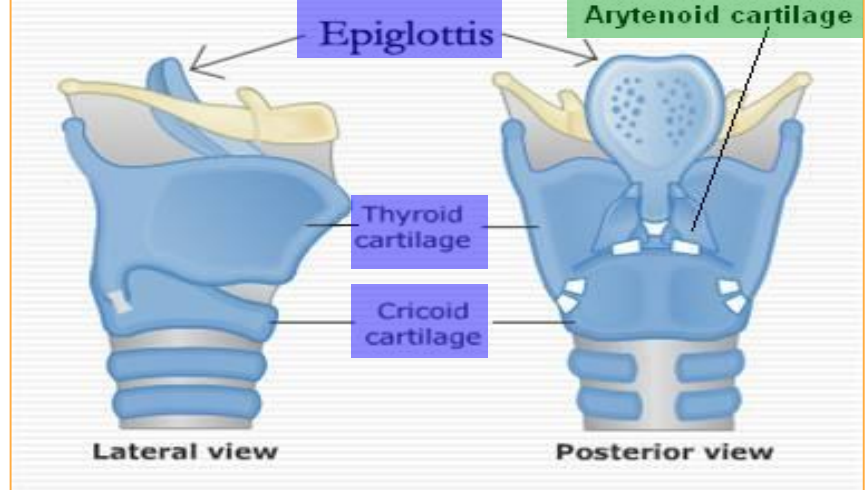
3 Paired (6):

- 1.Arytenoid (x2)
- 2.Corniculate (x2)
- 3.Cuneiform (x2)

• All the cartilages are **hyaline**, except the **epiglottis** which is **Elastic** cartilage.

• The cartilages are:

1. Connected by **joints, ligaments,** and **membranes**
2. Moved by **muscles.**



2-Membranes & Ligaments

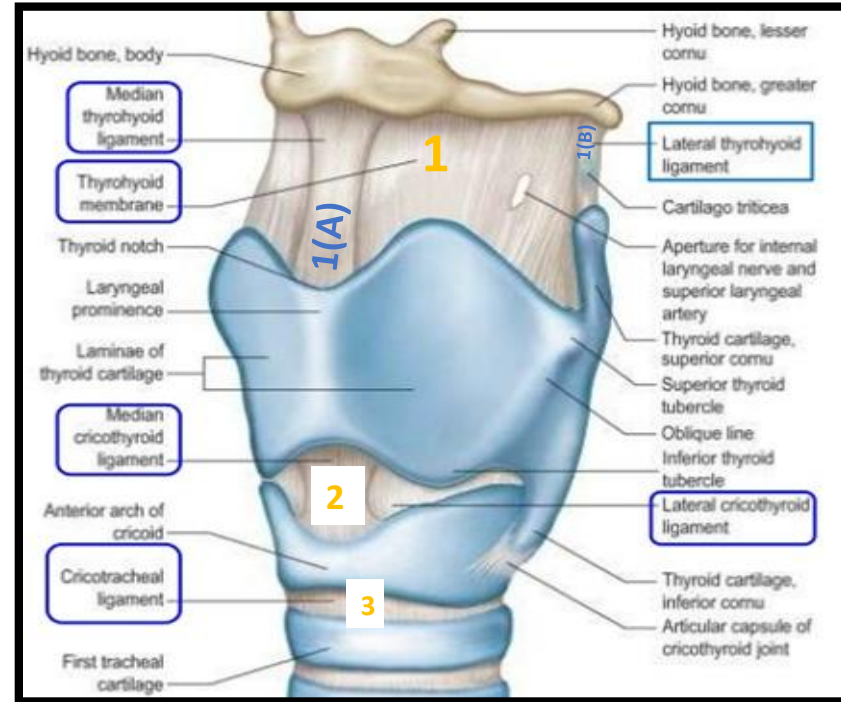
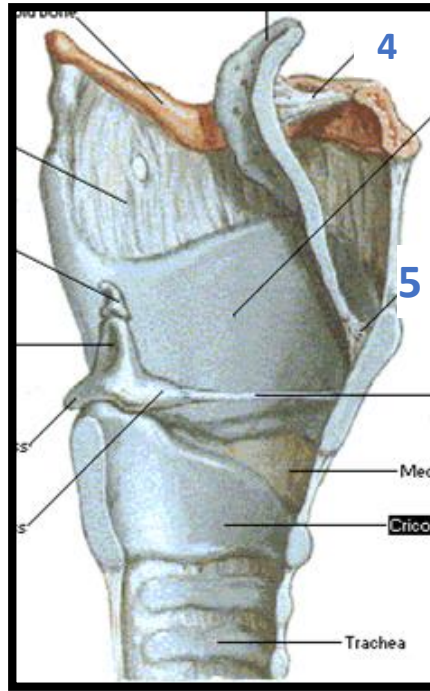
1-Thyrohyoid membrane: is thickened in the median plane to form **A) Median thyrohyoid ligament** and on both sides to form **B) Lateral thyrohyoid ligaments**

2-Cricothyroid membrane

3-Cricotracheal membrane

4-Hyoepiglottic ligament

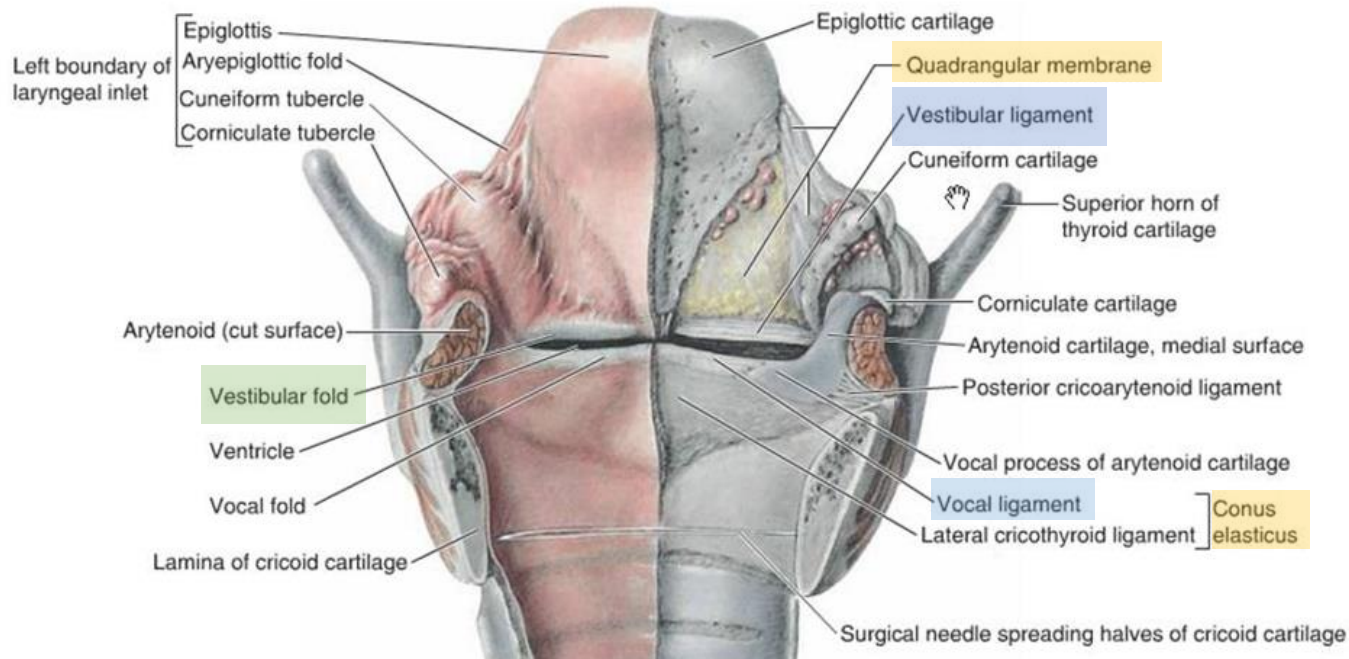
5-Thyroepiglottic ligament



6-Quadrangular **membrane** (aryepiglottic membrane): It extends between the **arytenoid** and **epiglottis**. Its lower free margin forms **the vestibular Ligament** which forms the **false vocal cord** or **vestibular fold**

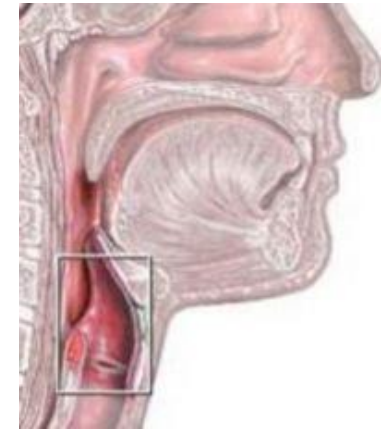
Cricothyroid membrane (no.2) (conus elasticus):

Its lower margin is attached to the **upper border of cricoid cartilage**. The **upper free margin** forms **Vocal ligament**



Laryngeal Inlet

- It is the **upper** opening of the larynx.
- It is directed **upward and backward** and opens into the laryngeal part of the pharynx (laryngopharynx).

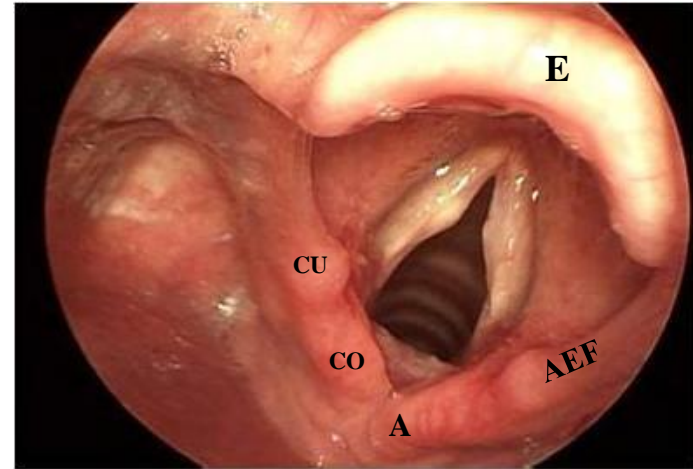


Bounded (next to it, surrounded) **by:**

- 1-Anteriorly: by the **upper** margin of **epiglottis (E)**
- 2-Posteriorly & below: by **arytenoid cartilages (A)**
- 3-Laterally: by the **Aryepiglottic folds (AEF)**

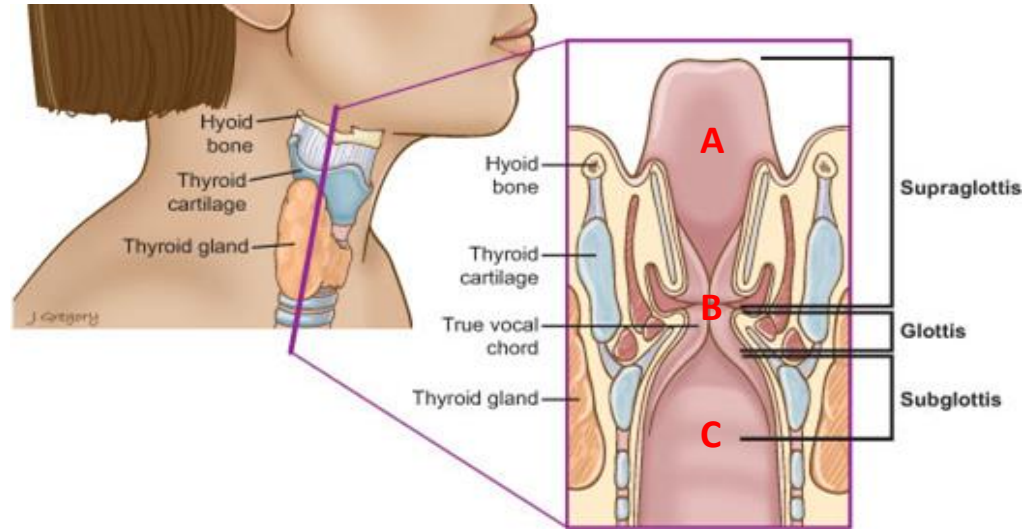
extra abbreviations:

CU=cuniform | **CO**=corniculate



Laryngeal Cavity

- Extends from **laryngeal inlet** to the **lower border** of the **cricoid cartilage**
- Narrow in the region of the **vestibular folds** (**rima vestibuli**)
- **Narrowest** in the region of the **vocal folds** (**rima glottidis**)
- Divided into **3 parts**:
 - A. **Supraglottic part or vestibule**: it is the part **above the vestibular folds**
 - A. **Ventricle**: it is the part **between the vestibular folds & the vocal folds**, it has an upward invagination called **saccul** which is **rich in goblet cells**
 - A. **Infraglottic part**: the part **below the vocal folds**



3-Mucous Membrane

- Laryngeal cavity is lined with **ciliated columnar epithelium** except The surface of vocal folds, which is covered with **stratified squamous epithelium** due to the exposure to continuous trauma during phonation.
- It contains many **mucous glands**, more numerous in the region of the saccule (for lubrication of vocal folds).

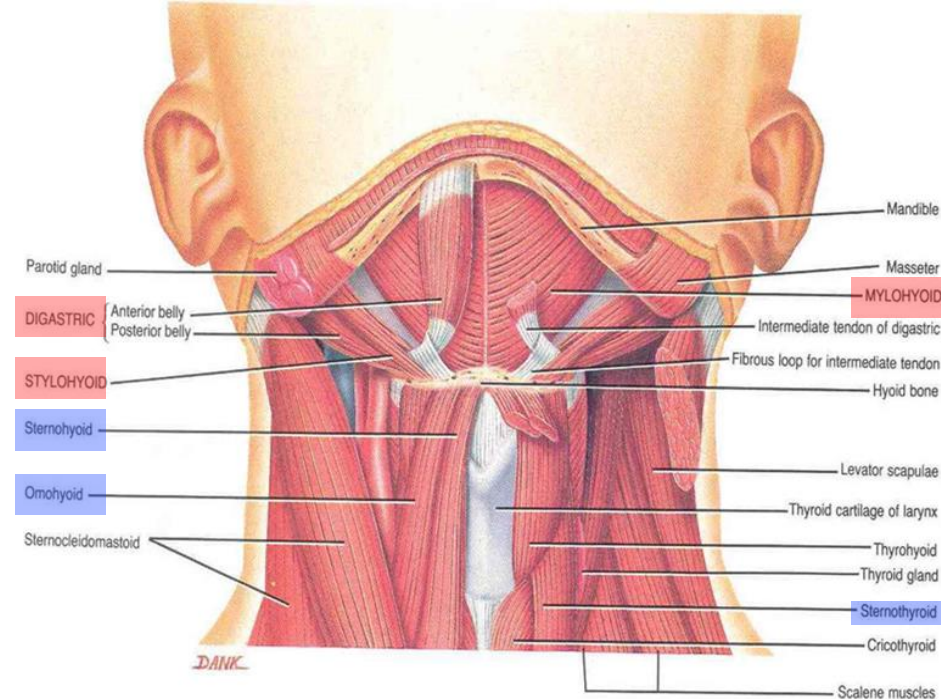
4-Muscles

Laryngeal muscles are divided into **2** groups:

- ❖ **Extrinsic muscles:**
 - Elevators of the larynx.
 - Depressors of the larynx.
- ❖ **Intrinsic muscles:**
 - Muscles controlling the **laryngeal inlet**.
 - Muscles controlling the **movements of the vocal cords**.

Extrinsic muscles

- ❖ **Elevators of the larynx.(7)**
 - The Suprahyoid Muscles: 4 -->(MSGD)
 - **M**yllohyoid
 - **S**tylohyoid
 - **G**eniohyoid
 - **D**igastric
 - The Longitudinal Muscles of the **Pharynx: 3**
 - **S**tylopharyngeus.
 - **S**alpingopharyngeus.
 - **P**alatopharyngeus.
- ❖ **Depressors of the larynx (The Infrahyoid Muscles):3**
 - **S**ternohyoid.
 - **S**ternothyroid.
 - **O**mohyoid.

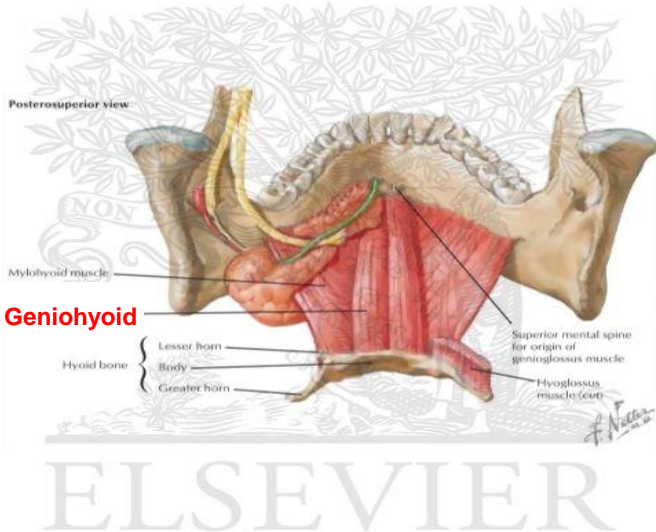


Images of Longitudinal

Muscles of the Pharynx + Geniohyoid muscle:

The Longitudinal Muscles of the **Pharynx: 3**

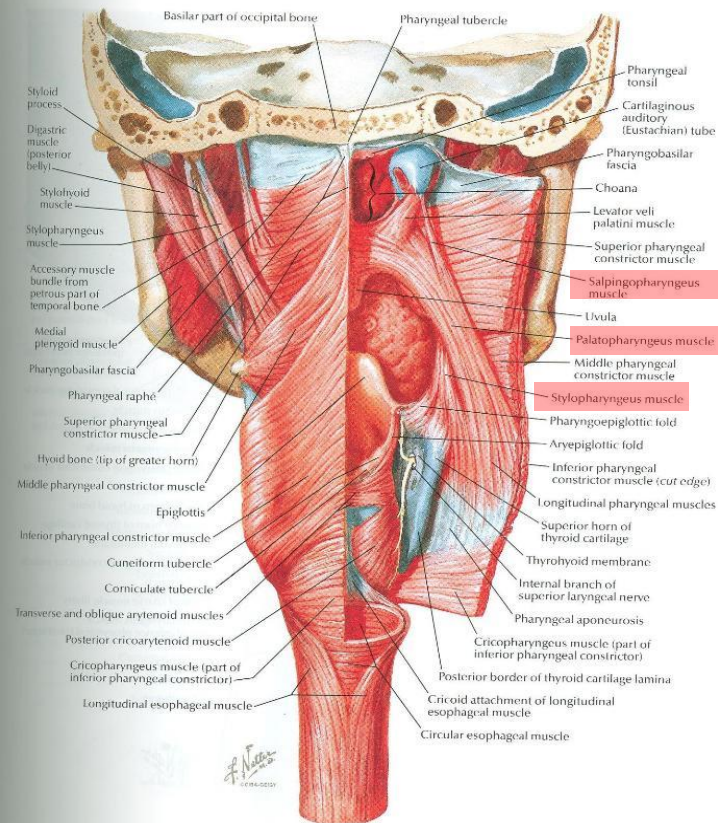
- **Stylopharyngeus.**
- **Salpingopharyngeus.**
- **Palatopharyngeus.**



MSGD:
Geniohyoid

Muscles of Pharynx: Partially Opened Posterior View

SEE ALSO PLATE 223

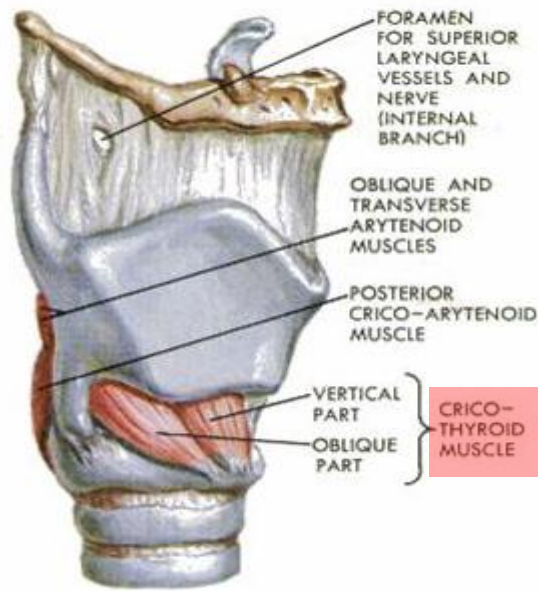


PHARYNX

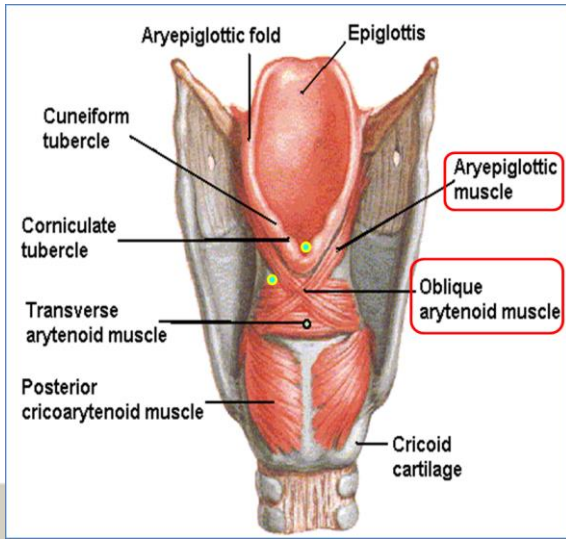
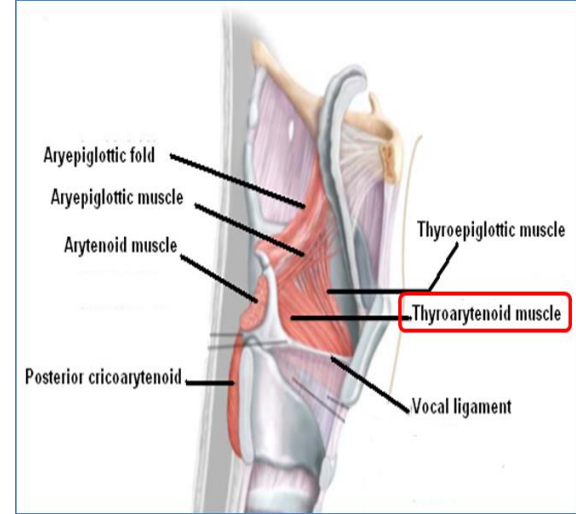
PLATE 61

Intrinsic muscles

- ❖ Muscles controlling the **laryngeal inlet**.
 - **Oblique arytenoid.**
 - **Aryepiglottic muscle.**
- ❖ Muscles controlling the **movements of the vocal cords**.
 - Muscle **decreasing** the Length & Tension of Vocal Cords (**relax**):
Thyroarytenoid (vocalis)
 - Muscle **increasing** the Length & Tension of Vocal Cords:
Cricothyroid.



It is only intrinsic muscle which found outside the larynx.



Movements of the Vocal Cords

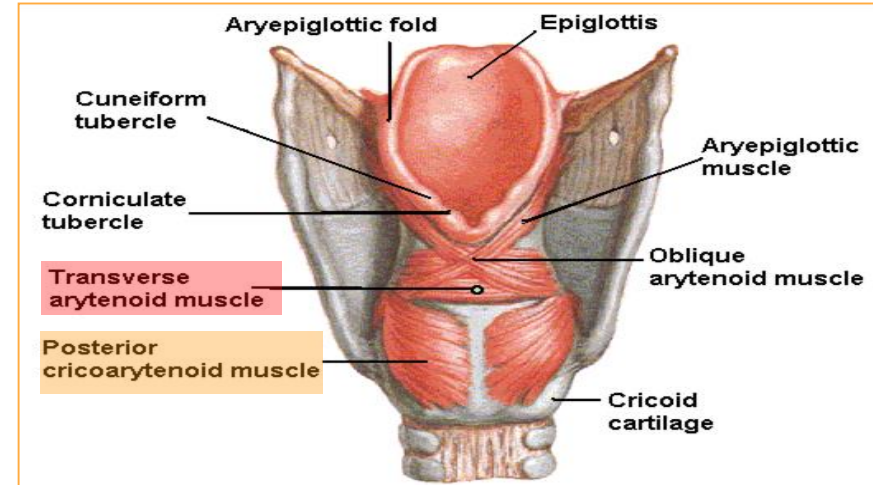
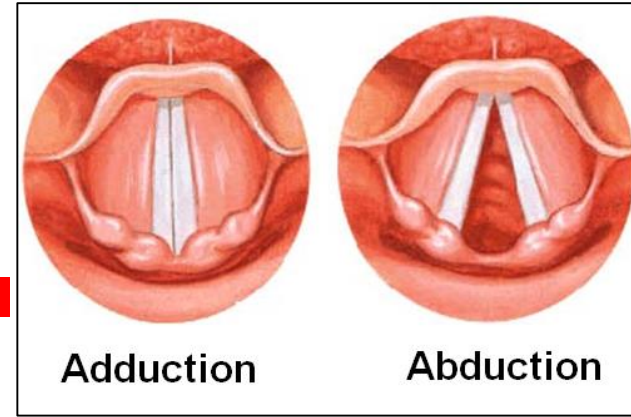
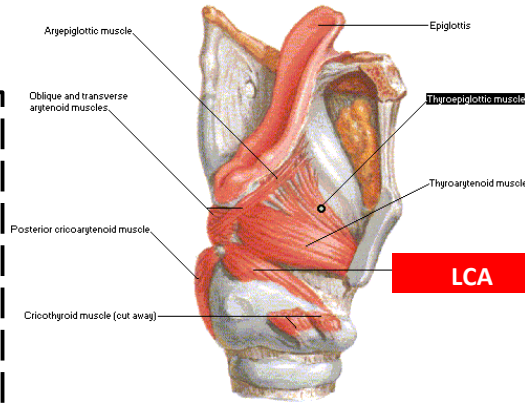
Adductors

- Lateral cricoarytenoid. (LCA)
- Transverse arytenoid.

Abductor

- Posterior cricoarytenoid

Intrinsic Muscles of Larynx
Lateral Dissection



Blood Supply

❖ Arteries

- **Upper half:** Superior laryngeal artery (branch of **superior** thyroid artery).
- **Lower half:** Inferior laryngeal artery (branch of **inferior** thyroid artery).

❖ **Veins:** Accompany the corresponding arteries.

❖ **Lymphatics:** The lymph vessels drain into the **deep cervical lymph nodes**.

Nerve Supply (very important)

❖ Sensory

- **Above the vocal cords:** Internal laryngeal nerve, branch of the superior laryngeal of the vagus nerve.
- **Below the vocal cords:** Recurrent laryngeal nerve, of the vagus nerve

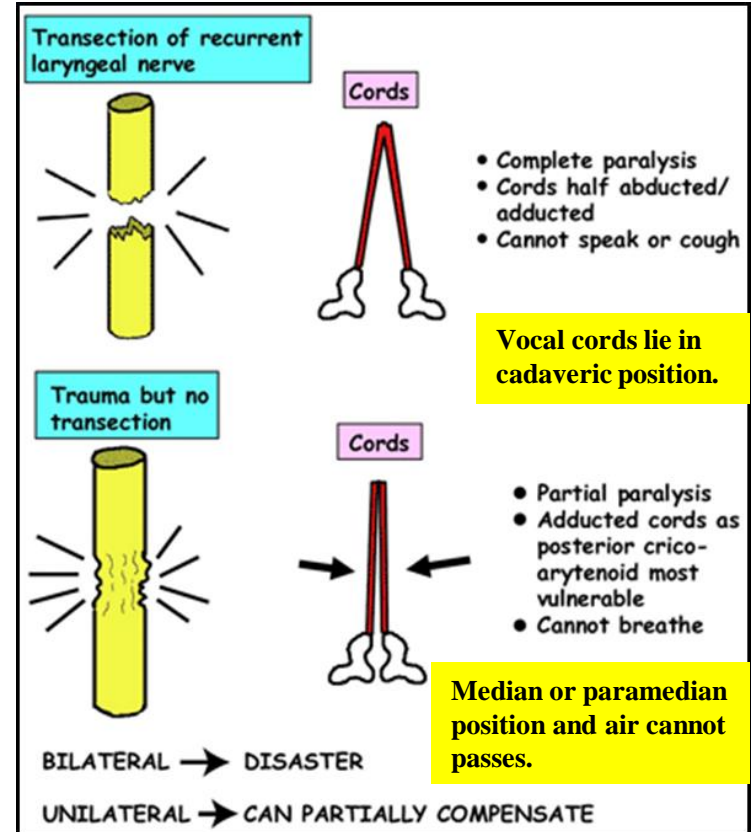
❖ Motor

- All intrinsic muscles, are supplied by the recurrent laryngeal nerve **except** the cricothyroid.
- The cricothyroid supplied by the external laryngeal nerve of superior laryngeal of vagus

SEMON'S LAW or Damage of the Recurrent Laryngeal Nerve:

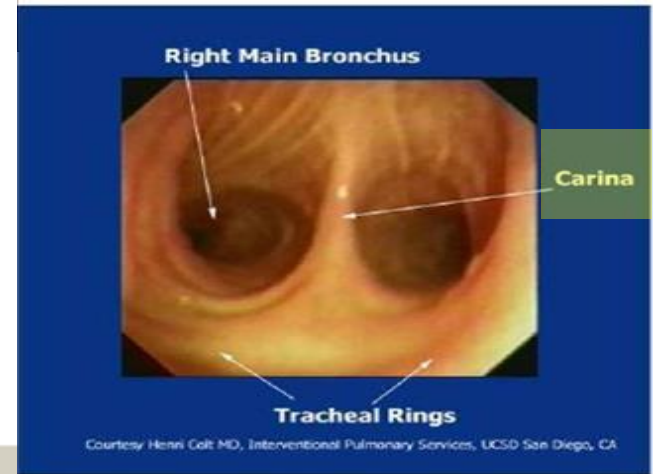
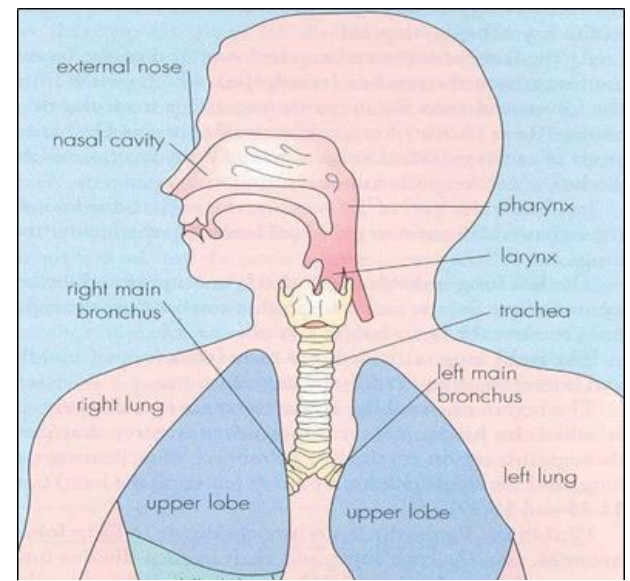
Semon's Law indicates the different effect between damage (surgical trauma) and transection of the recurrent laryngeal nerve due to **surgery in region of the neck (e.g. thyroidectomy or parathyroidectomy)**.

yellow = found in girls' lecture



Trachea (windpipe)

- ❖ **Mobile, fibrocartilginous tube, 5 inches long, 1 inch in diameter**
- ❖ **Begins:**
In the neck below the cricoid cartilage of the larynx (**C6**).
- ❖ **Ends:**
In the thorax at the level of **sternal angle** (lower border of **T4**), by dividing into right and left principal (main, primary) bronchi
- ❖ The ridge at the bifurcation from inside is called carina
- ❖ It is the **most sensitive part** of the respiratory tract and is associated with the **cough reflex**.



Anteriorly

- 1-Arch of aorta
- 2-Thymus (**Remains of thymus gland**)
- 3-Left brachiocephalic vein
- 4-sternum

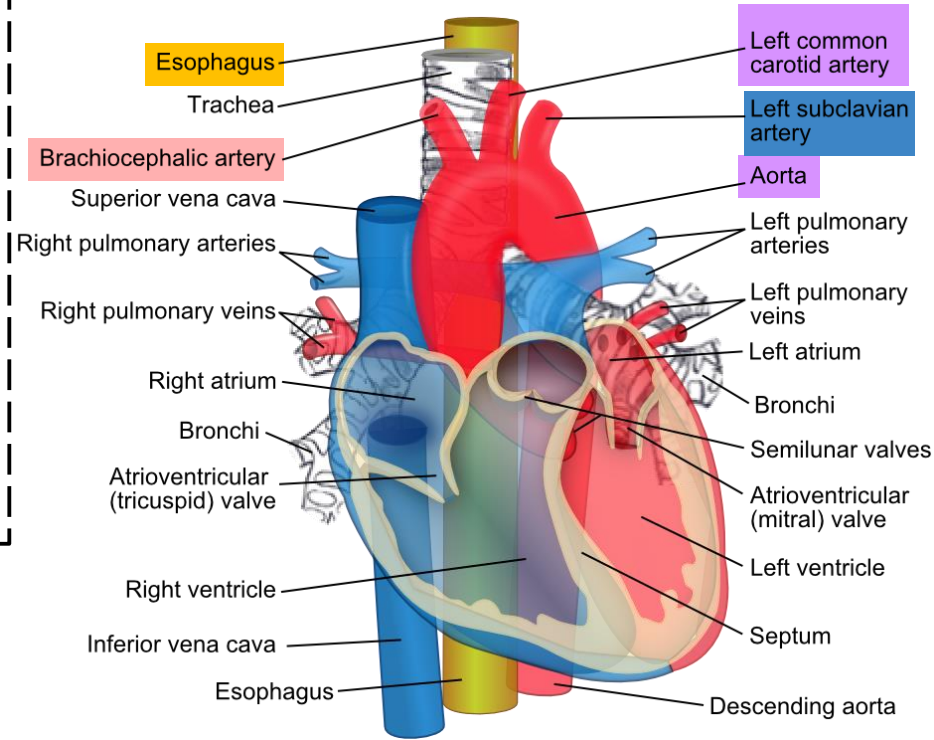
❖ Origin of:

- 5-Brachiocephalic artery
- 6-Left common carotid artery

Posteriorly

- 1-Esophagus
- 2-**Left** recurrent laryngeal nerve

Relations in the superior mediastinum



Left side

- 1-Arch of aorta
- 2-**Left** Pleura
- 3-**Left** subclavian artery
- 4-**Left** vagus nerve
- 5-**Left** phrenic nerve
- 6-Left common carotid artery

Right side

- 1-Azygos vein
- 2-**Right** vagus nerve
- 3-**Right** Pleura

Nerve Supply , Blood Supply , Lymphatic Drainage

Nerve supply

- 1-Branches of the **vagus nerve** and **recurrent laryngeal nerve** give **sensory** fibers to supply **mucus membrane**
- 2-Branches of the **sympathetic trunks** supply the **trachealis muscle** and **blood vessels**

Blood supply

- a-Arteries: branches from the **inferior thyroid** and **bronchial arteries**
- b-Veins: drain to **inferior thyroid vein**

Lymphatic drainage

Into the **pretracheal** and **paratracheal** lymph nodes

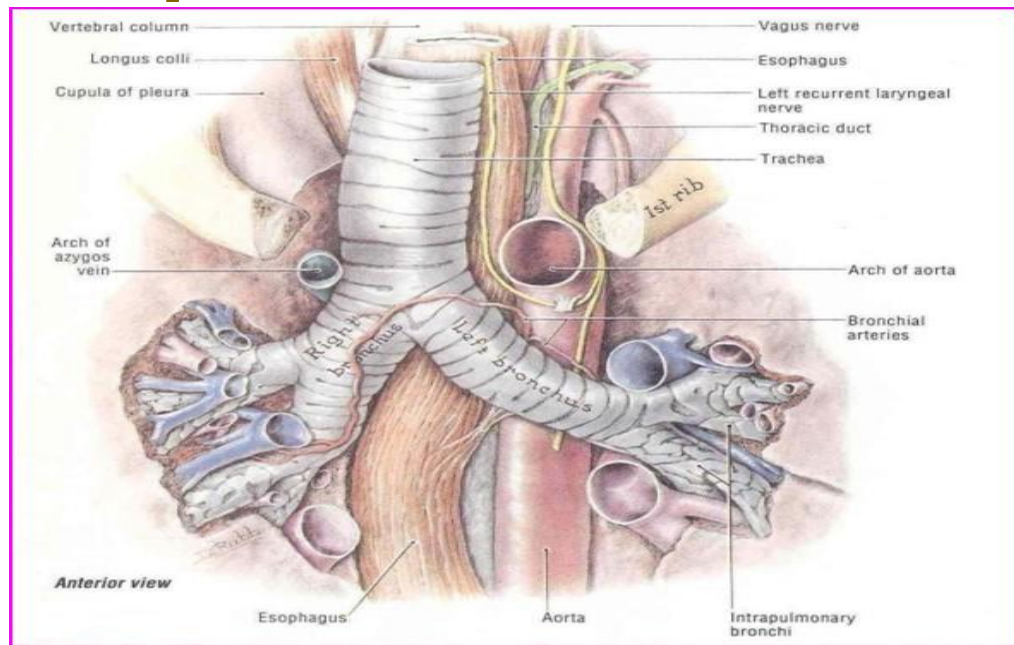
Right and Left Principal Bronchi

Right principal Bronchus

- One inch long
- Wider, shorter, and more vertical than the left
- Gives superior lobar bronchus before entering the hilum of the right lung
- On entering the hilum, it divides into middle and inferior lobar bronchi

Left principal bronchus

- Two inches long
- Narrower, longer, and more horizontal than the right
- Passes to the left below the aortic arch and in front of the esophagus
- On entering the hilum of the left lung, it divides into superior and inferior lobar bronchi

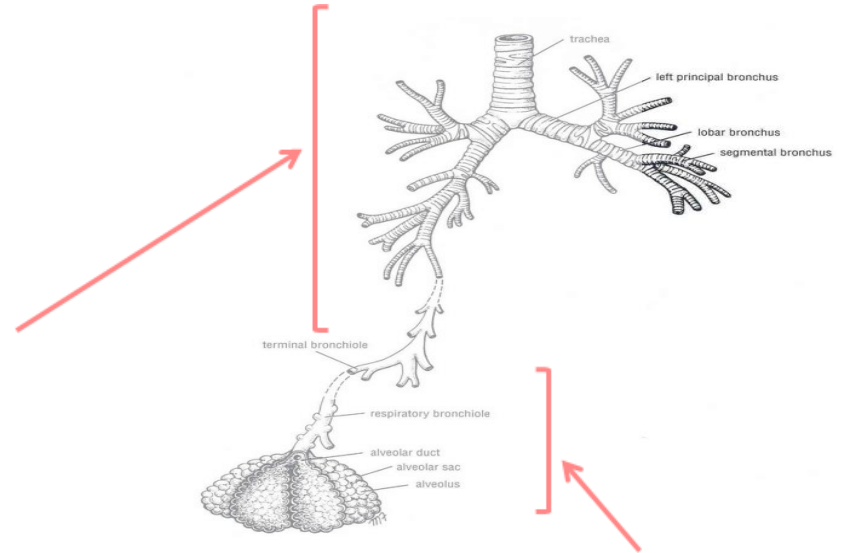


Bronchial Divisions

Within the lung, each bronchus divides and redivides into branches that can be divided into two groups:

1-Conduction zone branches:

- a-**Primary**(main) bronchi
- b-**Secondary**(lobar) bronchi
- c-**Tertiary**(segmental) bronchi that supply the **Bronchopulmonary segments** (Discussed later on)
- d-Smaller bronchi
- e-Bronchioles
- f-Terminal bronchioles



2-Respiratory zone branches:

- a-**Respiratory** bronchioles
- b-Alveolar **ducts**
- c-Alveolar **sacs**
- d-Alveoli

Summary

- ❖ Larynx (the voice box) is organ responsible for phonation is the respiratory system, and it also helps in deglutition and respiration (obviously)
- ❖ It's composed of four major structures:
 - 1-Cartilaginous skeleton
 - 2-Ligaments and membranes
 - 3- Muscles
 - 4-mucous membrane
- ❖ The upper opening of larynx is called the Laryngeal Inlet
- ❖ Laryngeal Cavity begins from the inlet and ends at the lower border of cricoid cartilage
- ❖ Semon's law indicates that a bilateral trauma of the recurrent laryngeal nerve is fatal state and needs to be treated immediately
- ❖ Trachea
 - ❖ **Begins:**
In the neck below the cricoid cartilage of the larynx (**C6**).
 - ❖ **Ends:**
In the thorax at the level of **sternal angle** (lower border of **T4**)
 - ❖ The ridge at the bifurcation from inside is called carina

- ❖ The primary bronchi are NOT similar to each other
- ❖ Bronchial devesions are devided to 2 zones
 - ✓ Conduction Zone
 - ✓ Respiratory Zone



Quiz:

<https://www.onlineexambuilder.com/larynx-trachea-bronchi/exam-56582>

هذا العمل إجتهد من طلاب و طالبات
إن أصبنا فمن الله وإن أخطأنا فمن أنفسنا ومن الشيطان

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